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BLOC INTERNATIONAL GEOPHYSICAL COOPERATION
- 1960

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INFORMATION ON SOVIET BLOC INTERNATIONAL GEOPHYSICAL COOPERATION - 1960

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INTERNATIONAL GEOPHYSICAL COOPERATION PROGRAM --

SOVIET-BLOC ACTIVITIES

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I. GENERAL

Transfer of Geophysics Station Announced

The geophysics station of the Institute of the Physics of the Earth imeni O. Yu. Shmidt which is located in the Petropavlovsk-Kamchatskiy region is being transferred under the jurisdiction of the Siberian Division of the Academy of Sciences USSR. This is being done in accordance with a resolution of the Presidium of the Academy of Sciences USSR, (On the Transfer of the Geophysics Station of the Institute of the Physics of the Earth to the Siberian Division"; Moscow, Vestnik Akademii Nauk SSR, No 5, 1960, p. 88.)

II. ROCKETS AND ARTIFICIAL EARTH SATELLITES

The Use of Television in Soviet Space Research

On 4 October 1959 a third cosmic rocket was successfully launched from the territory of the Soviet Union and sent to the region of the Moon. Its flight trajectory differed substantially from that of the two that had preceded it. The third cosmic rocket was to arrive near the Moon, curve around it, return to the vicinity of the Earth and transmit to our planet images of that part of the Moon's surface which cannot be observed from the Earth.

The cosmic rocket put an automatic interplanetary station into an orbit around the Moon; it did so for the conduct of scientific research and the transmission of images of the reverse side of the Moon. The station consists of an airtight container holding scientific apparatus and chemical power sources; certain scientific instruments, such as solar batteries and antennas, are outside the container. Included among the apparatus carried aboard the station are devices which make it possible to transmit images for distances of a hundred thousand kilometers.

How did such unusual television transmission come to pass? Before we answer this question, let's discuss the basic principles of ordinary terrestrial television.

As is well known, all television transmission is accomplished on the basis of the following principle: the image of the object is broken down into an immense number of individual elements with varying degree of brightness; information about the brightness of each of these elements is subsequently transmitted to a receiver.

If the image is projected onto the screen of a camera tube, electrical charges accumulate on each of the elements of the screen; the value of these charges is proportional to the illumination of these elements. The image on the screen of the camera tube is transformed from an optical to an electrical image. An electronic beam alternately

travels swiftly over all the elements of the screen, forming lines thereon, one above the other, and removing the charges, sending them into an amplifier and then into the transmitter.

At the end of the radio link an electronic beam traces these same lines on the screen of a picture tube covered with a fluorescent material. The intensity of the beam and the resultant brightness of the fluorescence of the different points on the screen changes in proportion to the value of the charges of the corresponding elements of the camera tube. An image therefore appears on the screen of the picture tube.

The quality of an image is appraised by its definition, that is, the degree of clarity in the reproduction of small details. Definition can be expressed by the maximum number of elements of which the image is composed. In the Soviet television system images are broken down into approximately 400,000 elements.

Another important index in television transmission is the time expended in the transmission of one frame. In Soviet television it is equal to 1/25 second.

Finally, the third index is the frequency band of the television signal.

The speed of change in the intensity of the scan-off beam can change in a wide range, depending on the form of the transmitted image. This is accomplished in such a way that there are no pairs of adjoining elements on the screen with identical charges. With the image broken down into 400,000 elements and the transmission time for one frame being 0.04 second, it is necessary for the beam to be able to change in intensity up to 5 million times a second. This means that the television channel should have an extremely great band width of 5 mc.

Let's return to the problems of cosmic television, to the transmission of images of the Moon's surface.

One of the most important characteristics of any radio link is its resistance to static, that is, its ability to carry transmissions properly, whatever be the interference. What is involved here is that other external electrical disturbances in addition to the useful signal arrive at the receiver; these make reception difficult and sometimes make it impossible. The sources of static are extremely varied: transmissions by other radio stations, an electric streetcar operating in the vicinity, radio signals of cosmic origin, a vacuum cleaner in use, a distant thunderstorm, the radioradiation from the Sun, and many others. Every electrical apparatus also has its own noises; these are due primarily to the chaotic thermal movement of electrons in different parts of the circuit, wires, etc.

The struggle against static involves the creation of such systems as will permit the reception of signals at the input of a receiving apparatus which have a power identical to or even less than the power of the static. This is achieved in a relatively easy and simple manner when we are dealing with ordinary terrestrial radio links; the problem is considerably more complex, however, when we deal with transmissions from space.

As is well known, the power of the transmitter aboard the automatic interplanetary station was calculated in watts. At the time of its flight the station could turn, changing its orientation in space and relative to the Earth; for the continual reception of its signals it was therefore necessary that the transmitting antennas have a circular form. For this reason the radio signals were transmitted equally in all directions and their power, with increasing distance from the station, decreased in proportion to the square of the distance. At distances of almost a half-million kilometers the power arriving on one square meter of the Earth's surface was 10^{-18} watts. In order to visualize how small this signal is, the following example may be given: if the transmitter of the automatic interplanetary station emitted a power equal to that of all the electric power stations of the world, the signal would still be several million times less in strength than the power needed to light the bulb of an ordinary pocket flashlight.

That is why the reception of signals from the automatic interplanetary station, in addition to very sensitive receiving devices and directional antennas, also required special methods for the processing and transmission of signals. This was true both at the station itself and on the Earth; in other words, a special static-resistant system had to be developed.

As is well known, static resistance can be increased by an increase in the power of the signal, the width of the transmission band, or an increase in its duration. Most circuits use one of these alternatives. It is clear that there can be no major increase in the power of the transmitter aboard the automatic interplanetary station. An increase in the band width is also infeasible. The latter is due to the reasons given below.

Such insignificant signals as travel from the station to the Earth can only be received by very sensitive receivers. The noise level at the output of the receiver depends to a high degree on the frequency band which it intensifies. If it is decreased by 10,000 times, for example, the noise level in the receiver itself will decrease by no less than 100 times. This means that it made sense to have a narrow-band transmission system in the automatic station, not a broad-band one.

The narrowing of the band, however, quickly leads to a decrease in the speed of transmission. Here is how this happens. Let's assume that the frequency band of our supposed television network is not 5 mc, but is 500 c instead -- that is, 10,000 times narrower. If it is required that the quality of the image (broken down into 400,000 elements) be stable, the time needed for the transmission of one frame should almost be a full 7 minutes -- not 0.04 seconds. Something similar applied in the case of the first cosmic rocket transmission. The use of special methods of processing, transmission and reception of signals could change only the degree of lowering of the speed of transmission.

But in a few minutes the automatic interplanetary station travels a hundred kilometers and no system of orientation can hold it all this time in a position in which the Moon's surface image will remain stable on the screen of the camera tube. It is clear that a quality image is simply impossible in such a case at the time of transmission to the Earth. The solution of this problem nevertheless appears obvious. It is necessary to photograph the Moon, process the film at the station, and transmit a fixed image to the Earth from the resulting negative. This method is also good in that it is possible to transmit the same frame several times and the transmission regime can be speeded up as the Earth is approached.

In order to photograph the reverse side of the Moon it was above all necessary to turn the automatic interplanetary station and the lenses of its cameras toward the Earth's surface at a fixed moment. At 0630 hours on 7 October 1959, when the station was situated at a distance of about 65,000 km from the Moon, the system of optical and gyroscopic units, complex electronic computers, and controlling motors accomplished this operation; subsequently they maintained the automatic interplanetary station in the necessary position for the entire period during which the Moon was photographed. Both lenses of the camera operated for 40 minutes, directed only at the Moon. During this time its reverse side was repeatedly photographed on a special 35 mm film at two different scales. After the exposure was completed the film entered a small device for automatic processing; there it was developed and fixed and then entered a cassette for television transmission.

Over the command radio link from the Earth to the interplanetary station went the orders "Begin transmission!" The necessary power sources were switched on and the automatic system began to operate, resulting in the coordination of the operation of all the links of the television apparatus. The transmission began.

The transformation of the optical image of the Moon -- present on the film negative -- into a complex of electrical signals was accomplished by a system with a camera tube. Such an arrangement is called a scanning-beam system. The light source is a well-focused fluorescent spot on the screen of the scanning tube. By means of deflecting devices this spot moves along the screen in horizontal and vertical directions, tracing lines, one under the other, across the screen. The image of this fluorescent spot is projected by means of a lens onto the transmitted frame. The beam of light passing across the photo film is collected by an optical device -- a "collector" -- onto the photocathode of a photomultiplier. Since the spot of light successively passes over and makes fluorescent the different parts of the frame, a television signal is received at the outlet of the photomultiplier; this signal changes in time, for the whole image.

A mixed system for scanning of the image was used in the television transmission from the automatic interplanetary station. The horizontal sweep was electronic, that is, it was accomplished by the electronic beam of the camera tube moving across the screen (this corresponded to the movement of the fluorescent spot across the frame).

The vertical sweep was mechanical. The film was continually drawn past the camera tube at a slow rate of speed. Mixed scanning was used because during the time of transmission, equal to several minutes, the mechanical system of slow drawing of the film is far simpler, reliable, and generally better than electronic vertical scanning.

The desire to get the most detailed possible photographs of that part of the Moon that is invisible from the Earth required that the photographs be made with the Moon's disk fully illuminated by the Sun. The absence of shadows due to head-on illumination led to a decrease in the contrast in the negative, that is, to a decrease in the transparencies of its dark and light places. In order to correct this inadequacy of the negative, its contrast was artificially increased by the use of change in the brightness of the spot in the camera tube of the phototelevision apparatus. The signal, thus corrected, arrived at the input of the narrow-band amplifier from the photoelectron amplifier and after certain transformations was sent out into space by the transmitter's antennas.

The signals, after reception and amplification, were recorded by apparatus of various types. Among them were special devices for the recording of television images directly on a film. The received signals control the brightness of its spot; the latter is focussed on the film by means of an optical system. The spot on the picture tube duplicates the motion of the spot on the camera tube; the film in the Earth-based apparatus moves at the same speed as on the automatic interplanetary station. Thus, the entire transmitted frame is "traced" on the film.

The relatively narrow band of the received television signal made it possible to a greater degree to magnetically record the signals. The signals of the image are recorded on a continually moving ferromagnetic film. As a result the film forms a recording which is magnetized differently in its several parts.

One of the varieties of electron-beam picture tubes used was the skiatron tube. In contrast to ordinary picture tubes the skiatron screen is covered with a substance (usually ion salts of silver chloride) that has the property, after bombardment with electrons, of taking on a capacity (on a long-term basis) of not radiating light as we are accustomed to, but of absorbing it. Under normal conditions the skiatron screen is quite transparent before reception begins. But when the electron beam has run across it, those places where it makes contact then become dark; the degree of darkening depends on the intensity of the beam at the moment of contact. The capacity of holding the received image for a long time is a peculiarity of the skiatron tube. The received image can be easily photographed directly from the screen, and in case of necessity it can even be projected onto a larger screen like an ordinary diapositive.

The use of special methods of recording has made it possible in the future, when comparing images received by the different methods, to eliminate or correct the specific mistakes inherent in each of them individually.

Thus was accomplished history's first television transmission from outer space. The unique photographs received of the reverse side of the Moon made it possible to make the first lunar globe. The transmission of images for a distance of 400,000 km confirmed the possibility of a quality television transmission from the outer reaches of space. This opens up immense vistas for the further study of the planets of our solar system and interplanetary space.

("Photo from Space", by Eng. V. A. Sokolov, Nauka i Zhizn', No. 3, 1960, p. 8-10.)

III. UPPER ATMOSPHERE

"Some Problems of the Physics of Auroras" -- A Full Translation of a Soviet Report

Spectral analysis is one of the effective means for investigation of the upper atmosphere. Its use for the study of radiation of the night sky (airglow) and auroras has enabled us to discover various micro-processes that arise as a result of photodissociation, ionization and recombination under the influence of hard ultraviolet, Roentgen and corpuscular radiation of the Sun, and many macroscopic processes and characteristics of the upper atmosphere, for example: temperature, inhomogeneities in atomic and allotropic composition, etc.

In the Soviet Union such investigations have been carried on at the Institute of Physics of the Atmosphere of the Academy of Sciences of the USSR and have been intensified in connection with the International Geophysical Year as the result of the development of high-quality spectrographs, interferometers, and rapid-action spectroelectrophotometers. Previously emissions of the night sky were usually recorded in the visible and near-infrared region of the spectrum (from 4,000 to 8,000 Å) with a total dispersion of several hundred Å per millimeter and a resolution of 10 Å. For photographing spectra in this region it was necessary to make long exposures on a single night or even on several nights. In so doing it was only possible to record several dozen emission lines. At the present time the region of spectral investigations has been widened to 12,000 Å and in the case of emissions of the night sky (airglow) it has become possible to cut the time needed for exposures to one hour or even to several dozen minutes, insuring resolution to 2 Å with a dispersion of 80 Å/mm. This success was to a considerable degree insured by the use of photocontact tubes -- electronic-optical transformers, whose fluorescent screens are attached to a very thin mica window about 20 μ thick (the photography is accomplished by pressing a photoplate against the mica from the outer side of the transformer).

Because of this we now have available a high-quality collection of photographs of spectra of the radiation of the night sky. These spectra contain more than 300 emission lines instead of the several dozen known earlier. Equally abundant material has been accumulated on the spectra of brighter auroras.

Jn a short article it does not appear possible to shed light on even the principal results of the observations mentioned above. We will therefore limit ourselves to those conclusions which this newly-collected material enables us to make about the energy levels in the upper atmosphere, principally on the basis of the spectra of auroras.

In recent years one of the principal problems of the physics of the upper atmosphere has been that of the sources of its heating and ionization. In order to explain the insignificant helium content in the Earth's atmosphere (helium liberated as the result of radioactive decay in the Earth's crust), even before the era of rocket research it was necessary to assume a temperature of several thousand degrees in the zone of dissipation of the atmosphere at a height of 500 to 800 km. At that time it was assumed that beginning at a level of approximately 100 km the temperature increases by 5° for each kilometer of height. As shown by Bates and Chapman, with such a gradient there would have to be a very great flux of heat from the high parts of the atmosphere to the 100 km level; at that level, for the most part, there is an intensive cooling due to the microwave radiation of atomic oxygen. This flux of heat is reckoned at a value of about $1 \text{ erg/cm}^2 \text{ sec}^{-1}$.

Later, by means of rockets, it was possible to precisely determine the intensity of the radiant energy of the Sun in the hard ultraviolet and Roentgen regions of the spectrum; it then became apparent that the energy absorbed in the atmosphere above 200 km is inadequate to explain the necessary flux of heat. The first determinations of the density of the upper atmosphere by means of ionization gauges to heights of about 200 km agreed with the temperature gradient of 5° per kilometer. In order to escape the difficulty of explaining the great heat flux from very high regions it became popular to consider the atmosphere above the 200 km level as isothermal, with a temperature no greater than 900° K. However, such a point of view caused serious doubts because it did not correspond with certain observational data.

It was natural to explain the heating of the upper atmosphere by the penetration therein of rapid charged and neutral particles: electrons, protons, and atoms of hydrogen and helium, as a result of the influence of the direct and indirect products of solar activity. Thus, there was talk of postulating frequent auroras at very great heights and of long duration -- auroras impossible to distinguish visually without special apparatus. The assumption of such sources of heating was natural for the polar regions. These sources seemed less probable for regions in the lower latitudes. We limit ourselves here only to problems having a direct relationship to the heating of the upper atmosphere.

The first type of spectrum of auroras is the ordinary spectrum of the night sky with an enhancement of the red forbidden emission of oxygen from a state with a mean lifetime of 100 seconds and an excitation energy of 2 ev. This emission is accompanied by a weaker forbidden emission of atomic nitrogen -- about 5,200 Å from a state with a mean lifetime of 26 hours and an excitation energy of 2.4 ev. The intensity of both emissions

correlates with one another and with magnetic activity. The next type of auroral spectrum is that in which, in addition to the emission indicated above, there is noted the beginning of an intensification of the green forbidden emission of atomic oxygen from a state with a lifetime of 1 second and an excitation of 4.2 ev and emissions of neutral and ionized molecules of nitrogen and atoms of nitrogen and oxygen with considerably greater excitation energies -- up to 25 ev. And, finally, a further type of auroral spectrum is that in which, in addition to the above emissions, there are bands of an ionized molecule of oxygen with a somewhat smaller excitation energy -- 18 ev.

The classification of auroral spectra given above can most easily be explained by the deep penetration of some active agent. The first type of aurora, usually faintly visible with the eye, corresponds to the radiation of very high rarefied layers of the atmosphere, predominantly of an atomic make-up, where the prolonged existence of metastable states is possible.

The next clear and visually easily observable type of aurora with an intensified green oxygen line and numerous emissions of a neutral and ionized nitrogen molecule is associated with regions of the atmosphere with molecular nitrogen. And, finally, the last type of aurora with the emission of ionized molecules of oxygen is in the region where molecular oxygen is present. The lower boundary of the auroras, easily determined by optical methods, is situated in a region where oxygen is in a molecular state.

It has been found that a large part of the energy of radiation of an aurora is concentrated not in its bright and sharply defined patterns -- which occupy a very insignificant area -- but in the surrounding weak and diffuse luminescence which fills immense surfaces above the Earth; the latter is hard to see visually due to the small contrast sensitivity of the eye when there is poor illumination. As a result of observations made outside the polar zone, in regions of the lower latitudes, it has been successfully determined that in such areas there are also characteristic spectral types of radiation of the upper atmosphere during auroras. However, in an overwhelming majority of cases the types observed here are at high levels. Spectra corresponding to lower heights are rare phenomena in the low latitudes. It should be noted that the first type of aurora, with a characteristic intensification of the red forbidden emission of oxygen and forbidden green emission of nitrogen, is customary in the region of Moscow even in the absence of any visually detectable auroras in regions with higher latitudes. In the region of Murmansk there is often a weak diffuse luminescence of the entire sky in which intensified green emissions of oxygen and emissions of ionized molecules of nitrogen are clearly detectable.

The conclusion suggests itself that either the energy of the corpuscles over the low-latitude regions is less than over the high latitude regions, or their depth of penetration is less due to the geomagnetic barrier.

From the distribution of intensities in the vibrational-rotational hydroxyl spectrum it is easy to determine the temperature of the surrounding medium. A sample of such a spectrum, recorded by N. N. Shefov, is shown in Figure 1. We discovered that even at a level of about 100 km, where the hydroxyl radiation arises, the temperature increases from approximately 200° K over the region of Armenia to 350° in the vicinity of Murmansk. Near Leningrad it is possible to note an increase in the rotational temperature of hydroxyl for emissions coming from the north side of the sky in contrast to emissions from the south. This difference is still greater over the region of Murmansk. By use of an interferometer one may easily determine the spectral width of the emission line, and, consequently, the temperature of the radiating medium. Figure 2 shows samples of photographs of the interference picture of auroral emissions as recorded by T. M. Mulyarchik. It has been determined that at the time of pronounced auroras in the region where the mentioned emissions originate, the temperature increases by several thousand degrees. The increase in the temperature of the upper atmosphere at the time of an aurora was also discovered over the region of Moscow from a study of the emissions of ionized molecules of nitrogen whose rotational temperature during auroras is sometimes several thousand degrees.

As we know, the radiant formations of auroras have a very great vertical extent, sometimes exceeding 1,000 km. In this case it is extremely characteristic that the intensity of luminescence of a ray at different heights is not subject to any substantial change. Inasmuch as the concentration of neutral molecules of nitrogen drops sharply with height, the maintenance of the intensity of the ray can be explained only by an increase in the flux of the ionizing agent.

In the investigation of auroras an effort was originally made to explain them by the penetration of rapid electrons into the Earth's atmosphere. In the last decade, however, after the discovery of wide emission lines, shifting into the blue region of the spectrum in the case of observations in the magnetic zenith, it has become popular to explain this phenomenon by the movement to the Earth of rapid streams of hydrogen atoms ejected by the Sun.

The use of sensitive apparatus with high resolving power makes it possible to accomplish a regular recording of wide hydrogen emission. At one intensity or another it has been possible to record the emission in almost all forms of auroras. Hydrogen emission usually occupies extensive areas of the sky and is to some extent associated with the clearest formations of auroras. As a rule, it may be observed for several hours before the appearance of a pronounced aurora and sometimes ceases without its appearance. Such an unconcentrated luminescence of hydrogen is easy to explain by the disruption of movement of protons around the magnetic lines of force as a result of their effective overcharge with atomic oxygen. Figure 4 shows a sample of the hydrogen spectrum and the lines of hydrogen emission in comparison with a spectrum containing an ordinary hydrogen emission of atmospheric origin. It is extremely

interesting that the maximum intensity of the hydrogen in the magnetic zenith corresponds to the very low velocities (3,000 km/sec) of intruding atoms of hydrogen; this is difficult to collate with the time lag in the appearance of the hydrogen emission relative to the characteristic formations of solar activity. The observed line of the hydrogen emission may be due only to the dispersion of the velocities of the corpuscles -- and these cannot be the primary particles ejected by the Sun.

Although a broad hydrogen emission of one intensity or another is observed at the time of a majority of auroras at any stage of development, nevertheless the majority of bright auroras with strong molecular emissions is not accompanied by such hydrogen emission. A broad hydrogen emission, as a rule, is most commonly observed simultaneously with spectra of the high-level type, which, however, often do not contain it. It is natural to assume, therefore, that a considerable part of auroras is caused by the penetration into the atmosphere of electrons with energies of about 10 kev. This assumption is based on the fact that it is with such an energy that electrons are capable of penetrating to a height of 100 to 120 km, at which level auroras become visible.

In order to demonstrate the existence of such electrons in the upper parts of the atmosphere, even in the absence of a visually observable aurora, we used the third artificial earth satellite. A special apparatus was designed and built; this was used to record streams of expected electrons with an intensity that had not been anticipated earlier. A considerable part of the time the apparatus was in a "scaled" condition. In those cases when there were data on two indicators, it was possible by taking the ratio of the intensity of their signals to estimate the equivalent energy of the electrons. It was discovered that the value of such equivalent energy is about 10 kev. If at the moment of "scaling" of the apparatus the electrons possessed the same energy, the total energy of the streams of electrons would attain thousands of erg/cm². sec. The direction of movement of a majority of the high-energy electrons forms an angle exceeding 50° with the magnetic lines of force. These electrons, as a result of the magnetic barrier, cannot penetrate into the lower part of the atmosphere. In the field of ionospheric layers only a small number of high-energy electrons move at an angle of less than 50° to the magnetic lines of force. This current of energy amounts to about 1 erg/cm². sec and is sufficient to insure a temperature gradient of 5° per kilometer.

It has been established that at great heights, in particular in the high latitudes, there is an increase in the concentration of electrons with an energy of about 10 kev; these may be primary solar corpuscles. At the time of auroras and geomagnetic perturbations the zone with high-energy electrons drops downward. As a result, the heating of the upper atmosphere, particularly in the high latitudes, is more extensive and is in great contact with rapid electrons. Due to its low density the higher regions of the atmosphere are heated considerably more rapidly and with less expenditure of energy than the lower-lying ones. Now, on the basis of the braking of the artificial earth satellites, we have actually

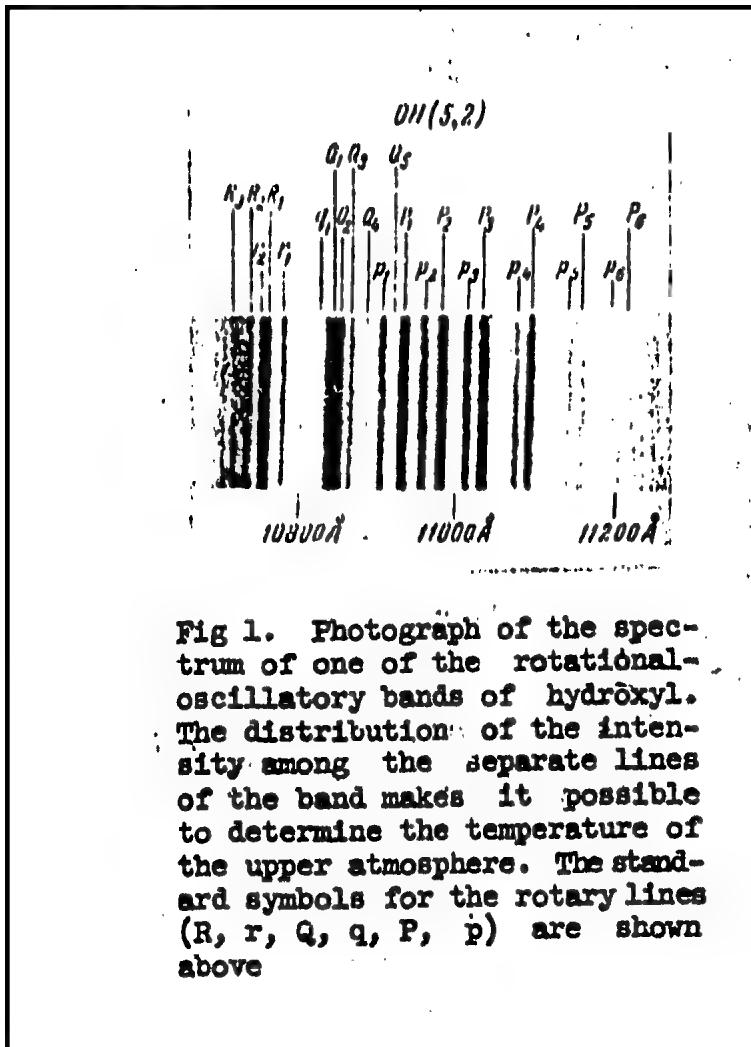
succeeded in discovering high density; consequently, the temperature of the atmosphere in the region above 200 km, in particular over areas in the high latitudes, has been determined.

The protons and electrons causing the phenomenon of auroras and the heating of the upper part of the atmosphere, have velocities which do not at all agree with the time lag in the beginning of the appearance of auroras in relation to the time of the origin of characteristic active formations on the Sun. Therefore such protons and electrons cannot be the primary particles ejected by the Sun. Instead they arise as a result of the complex interaction between clouds of ionized gas ejected from the Sun and the ionized gas held by the geomagnetic field.

Although at the present time extremely interesting peculiarities have been discovered in the spectra of auroras and we have directly recorded rapid active particles in the Earth's outer atmosphere, we nevertheless need further systematic observations of all the above-described phenomena. Then it will be possible to establish to what extent they are constant in the course of the cycle of solar activity. Therefore the continuation of the research that has been conducted in the course of the International Geophysical Year is of great scientific and practical interest.

CPYRGHT

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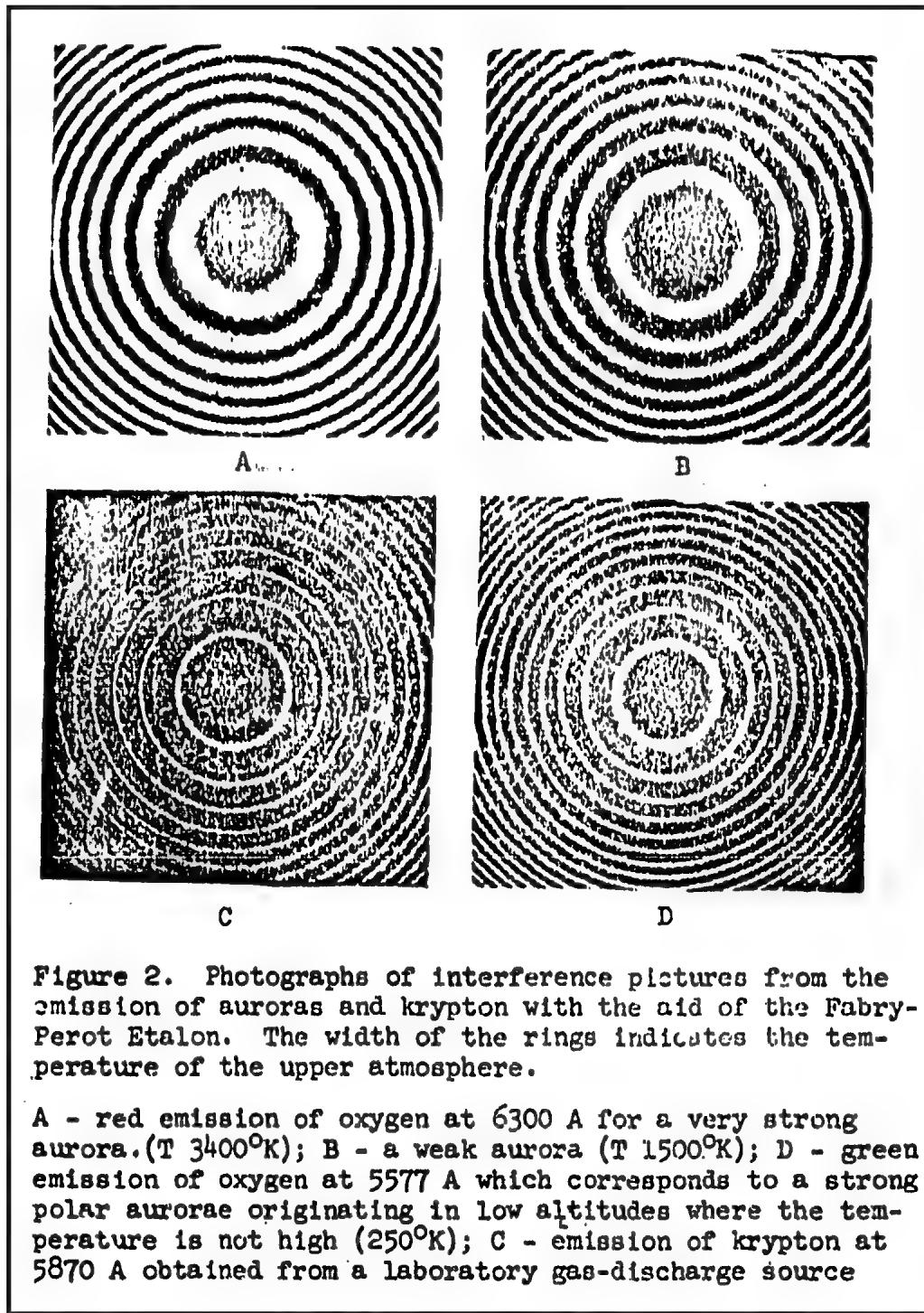


Figure 2. Photographs of interference pictures from the emission of auroras and krypton with the aid of the Fabry-Perot Etalon. The width of the rings indicates the temperature of the upper atmosphere.

A - red emission of oxygen at 6300 Å for a very strong aurora. ($T 3400^{\circ}\text{K}$); B - a weak aurora ($T 1500^{\circ}\text{K}$); D - green emission of oxygen at 5577 Å which corresponds to a strong polar aurorae originating in low altitudes where the temperature is not high (250°K); C - emission of krypton at 5870 Å obtained from a laboratory gas-discharge source

CPYRGHT



Figure 3. Photograph of a rayed arc of an aurora. To the left can be seen rays with fairly constant brightness

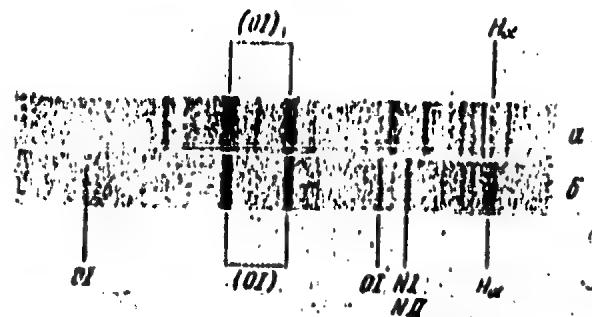


Figure 4. Photograph of the spectra of airglow and auroras at the magnetic zenith in the red region of the spectrum. Exposure during the aurora was considerably less than during its absence. Therefore there is no hydroxyl band on the auroral spectrum. In the airflow spectrum there is a narrow emission line of H_{α} hydrogen, and in the auroral emission it is broadened and its center is shifted to the blue region of the spectrum by 6 Å

a - airglow

b - aurora

("Some Problems of the Physics of Auroras", by V. I. Krasovskiy [Doctor of Physical-Mathematical Sciences], Vestnik Akademii Nauk SSSR, No. 5, 1960, pp. 10-16).

Tadzhik Institute of Astrophysics Engaged in "Meteor Patrol"

The following is the translation of a photo caption appearing in Izvestiya on 19 June 1960:

The Institute of Astrophysics of the Tadzhik Academy of Sciences has established a scientific laboratory near Stalinabad for the photographic observation of meteors. "On the basis of observations which we have made by use of cameras developed by the staff of this Institute", says Pulat Babadzhanyich Babadzhany, the Director of the "Meteor Patrol" laboratory, "it is possible to study the physical conditions prevailing in the upper layers of the Earth's atmosphere and meteoric matter in the solar system". [The photograph shows the "Meteor Patrol" equipment.] (Untitled photograph, Izvestiya, 19 June 1960, p. 4)

CPYRGHT

"Electrical Discharge During the Flight of Meteors in the Earth's Atmosphere"

A four-page article recently appearing in a publication of the Academy of Sciences of the USSR is devoted to electrical discharges during the passage of meteors through the Earth's atmosphere; the article cites 14 bibliographical references. The author is V. P. Dokuchayev of the Radiophysical Scientific Research Institute at Gor'kiy State University im. N. I. Lobachevskiy.

("Electrical Discharge During the Flight of Meteors in the Earth's Atmosphere", by V. P. Dokuchayev, Doklady Akademii Nauk SSSR, Vol. 131, No. 1, 1960, pp. 78-81)

Soviet Popular and Semi-Popular Press Continue Publication of High-Quality Articles on Space Research

Numerous accounts in the Soviet popular and semi-popular press deal with the radiation belts surrounding the Earth. Another such account has appeared in the journal Tekhnika-Molodezhi. Although nothing new is contained in this article that warrants summarization, it is written on a high plane and is typical of the highly technical material on space research that often appears in Soviet periodicals designed for popular consumption. ("Magnetic 'Trap' on the Route to the Cosmos", by I. Ivanenko, Tekhnika-Molodezhi, No. 5, 1960, pp. 35-36)

IV. METEOROLOGY

Yellow Rain Falls in the Georgian SSR

A dispatch published in the Soviet press has reported that colored rain has fallen in the Georgian SSR.

The rain fell at night, states O. Shantidze, Chief of the Kutaisi Meteorological Station; the morning after the window panes in houses, the windows of automobiles, and the leaves of trees were a yellow color.

G. Bukhnikashvili, chief of a meteorological station at the Krestovyy Pass, 2,200 meters above sea level, reports that colored rain has fallen there three times during the past year -- bright yellow in the winter, reddish in March, and yellow in the present instance.

Sh. G. Gavasheli, Director of the Tbilisi Hydrometeorological Observatory, stated that this phenomenon was caused by cool moist air masses coming from the northwest, mixing in the upper layers of the troposphere with warm dry air which had moved from the southwest and which evidently contained a large amount of dust. Such precipitation, he states, is not only easy to explain, but is also completely harmless. ("Weather Forecasts Do Not Predict Such Things", Izvestiya, 15 June 1960, p. 6)

New Soviet Weather Ship Makes Trial Run In Black Sea

The new weather ship "Shokal'skiy" approached the wharves of the port of Odessa a few days ago. It had undergone a test run in the Black Sea for several days. We asked one of the leaders of the expedition -- the Director of the Central Aerological Observatory, G. I. Golyshev, to tell about the first cruise of the ship and the work which it will accomplish in the future.

"The 'Shokal'skiy' is an expeditionary ship which has only recently left the ship yards at Nikolayev", said G. I. Golyshev. "This vessel is an exact replica of the 'Voyseykov', the first Soviet ship of the Hydro-meteorological Service, now conducting research in the Pacific Ocean".

"At the time of the voyage the sixteen laboratories aboard the vessel were engaged in a variety of scientific investigations. The ship was equipped with apparatus for the launching of meteorological rockets from the deck. The instruments located in the nose of such a rocket transmit data about the state of the atmosphere to heights of 80 km. Radio receiving apparatus on board receives information about temperature and pressure and about the character of solar radiation. At the time of the tests aboard the 'Shokal'skiy' five meteorological rockets were launched. All transmitting instruments and receiving apparatus operated faultlessly".

"The investigation of the atmosphere over the ocean is of great importance to science. The ship can conduct observations in different latitudes. It will become a very mobile scientific station, situated thousands of miles from land, but quickly transmitting all data to the weather service".

"In addition to the launching of rockets the men aboard the weather ship conduct all the meteorological observations customary for meteorological stations; the launching of radiosondes enables us to judge about the state of the atmosphere to heights of 30 km. The scientific laboratories of the 'Shokal'skiy' are also conducting an extensive program of oceanographic observations".

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"In the very near future a second weather ship will move out on the distant route that leads to the Pacific Ocean where the 'Shokal'skiy' will accomplish a complex of scientific research operations in collaboration with its older companion the 'Voyeykov'. The new expeditionary ship will enable us to still more rapidly penetrate into the unknown secrets of the marine depths and cloudy heights".

("Secrets of the Depths and Heights", Izvestiya, 18 June 1960, p. 1)

V. LONGITUDE AND LATITUDE

A Report on the Soviet Latitude Service

The following is a full translation from the Soviet popular science magazine Nauka i Zhizn':

There is a beautiful shady park at a distance of 405 km from Tashkent on the Great Uzbek Highway. There, to one side from the bustling of the city, in the dense greenery of secular linden trees and fruit trees, are to be found the observation pavilions of the Kitabskaya International Latitude Station im. Ulugbek of the Academy of Sciences of the Uzbek SSR.

The scientists at this station are dealing with many interesting problems, but their principal field of observations is variation in geographic latitude.

The determination of latitude is one of the most interesting problems of astronomical science. Newton, when he studied the problem of the Earth's rotation, came to the conclusion that the poles should move along the surface of the globe. This hypothesis was confirmed by L. Euler; he developed the theory of rotation of a solid body around a fixed point. Euler demonstrated theoretically that the Earth's axis should move within the Earth, describing a cone with a very small angle at its peak. He figured that this caused the movement of the poles along the Earth's surface.

But if the poles constantly move, the geographic latitude of a place cannot remain constant.

The first practical demonstration of Euler's theoretical conclusion was the research conducted by the astronomer Kh. Peters, a worker at the Pulkovo Observatory. In 1842-1843, while observing Polaris, he established that the latitude of Pulkovo constantly undergoes small changes.

These conclusions interested the scientists of various countries. Special observations were made at many observatories for the purpose of determining the local latitude. It became clear that the latitudes of areas where observatories were situated were actually subject to variation. However the latitude received from astronomical observations can be distorted and influenced by meteorological phenomena.

In order to finally clarify the cause of this variation in latitude it was decided to systematically make observations of changes in latitude at two points of the globe, situated 180° in longitude away from one another: at Berlin and at Honolulu in the Hawaiian Islands. If it is

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assumed that the change in latitude arises from the movement of the Earth's poles, an increase in the latitude of Berlin should correlate with a decrease in the latitude of Honolulu, and vice versa.

When a sufficient number of observations had been made and latitudes had been computed, it was discovered that in that period when the latitude of Berlin had increased or decreased by some fixed value, the latitude of Honolulu, on the contrary, had decreased or increased by precisely the same value.

Thus it was finally demonstrated that change in latitude is caused by a movement of the Earth's poles.

Careful investigations of numerous observations made at various observatories have shown that the movement of the poles is extremely complex. It has been found that in its movement the pole describes a complex spiral-shaped curve on the Earth's surface; this curve first curls in, then uncurls, but does not go beyond the limits of a square with sides 30 meters long. Such a line results from the superposition of several movements with different periods. The two principal movements depend on the internal structure of the Earth and seasonal changes on the globe caused chiefly by a movement of air masses at different seasons of the year and also by the falling and melting of snow.

These discoveries have stirred up very lively interest among the scientists of the entire world. In the observatories of the various countries of the world special observations have begun for the purpose of studying changes in latitude. This problem proved to be especially important for astronomers. The fact is that the systems of coordinates with which astronomers had to work were tied in with the Earth's poles. But if the poles move, there is also a change in the system of coordinates; consequently the coordinate of the objects themselves, determined by observations, will be distorted. Therefore all precise astronomical determinations must be adjusted to take into account the movement of the poles. It therefore appeared necessary to get precise information about the movement of the poles.

But the greater the volume of information accumulated, the more it became apparent that the derivation of a reliable curve for movement of the pole made by observations using different methods, different instruments and different stars, was extremely complex. It became clear that a special "latitude service" was needed to coordinate all these observations. In 1898 such a unified center was established and named the International Latitude Service. The Service had the following observatories, called latitude stations. It was decided to establish such stations in the Northern Hemisphere on latitude $39^{\circ}08'$ at 4 points: Mizusawa (Japan), Carloforte (Italy), Gaithersburg and Ukiah (USA). To these four stations, established at the expense of the International Geodetic Association, were added still two others: an observatory in Cincinnati (USA) and a special latitude station at the city of Chardzhou,

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established by the Russian government at its own expense. The Russian station continued to operate until 1919. In the bloody days of the civil war it was forced to bring its work to a close.

The absence of a latitude station in the Soviet Union had a negative effect on the work of the entire International Latitude Service because there was not a single latitude station in the immense distance between Italy and Japan. In 1925 the Soviet government adopted a resolution concerning the establishment of a new latitude station. The place of observation selected was Kitab, situated on the international parallel -- $39^{\circ}08'$. The first observation in accordance with the international program at the Kitab latitude station was made on 14 November 1930. Regular and planned research in the field of latitude has been conducted at this station since that date.

During the years of the Second World War, when a majority of the latitude stations were forced to temporarily suspend their observations, it was decided to create within our country its own latitude service. In addition to the Kitab latitude station it included the Pulkovo Observatory, the Poltava Observatory, the Engel'gardt Observatory at Kazan, and latter -- in connection with the International Geophysical Year -- a station at Blagoveshchensk-na-Amur and the Irkutsk Observatory.

These stations are situated on different parallels and rather close to one another in longitude. Their accuracy in determination of the coordinates of the pole is therefore not great. However the results of research are completely adequate for practical purposes. Thus, on the basis of such observations, it is possible to make up summaries of the coordinates of the pole on a monthly basis.

A new period in the activity of the latitude service began in connection with its participation in the work of the program of the International Geophysical Year. Five latitude stations form the International Service: Mizusawa (Japan), Kitab (USSR), Carloforte (Italy), and Gaithersburg and Ukiah (USA).

They all have observational pavilions that are built in a similar manner; they are equipped with instruments of the same type -- zenith telescopes -- and are conducting observations in accordance with a single international program.

Each latitude station sends the results of its observations to the Central Bureau of the International Latitude Service in Italy where they are generalized and studied. The latitudes of places are determined from observations of stars at these stations; on the basis of changes in these latitudes a curve is drawn of the movement of the Earth's north pole. The final results are issued by the Central Bureau in special publications which are used by different scientific institutions of the entire world.

The scope of the work at the Kitab station has also been considerably expanded. At Kitab the new Soviet-produced zenith-telescope "APM-2", the largest in the world, has now been installed. The aperture of its objective is 180 mm, the focal distance is 2,360 mm.

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These observations have enabled us to make a series of valuable investigations on the problem of latitude; these have been printed in various astronomical publications. In the near future plans call for the introduction of research of the astronomical regime for the purpose of clarifying the possibility of setting up astrophysical instruments there.

Of special interest are observations which are now being conducted with two zenith telescopes. An analysis of these observations over a period of 1½ years has shown that there is a clearly expressed annual wave in the differences noted; this means that the so-called Z-terms for these instruments are different. It is well known that the Central Bureau of the International Latitude Service considers the Z-terms for all International Latitude Service stations to be identical. Our results do not confirm this assumption.

On the completion of the International Geophysical Cooperation Program all these observations will be strictly systematized.

The astronomers at Kitab are doing a great deal of work for the popularization of science. They are systematically going out in the field to deliver popular science lectures in the villages, factories, schools and military units. During the time it has existed the observatory has acquired considerable fame. It is visited by numerous excursions of workers and collective farmers, students and soldiers from different regions. At Kitab they attend lectures on various astronomical subjects and can inspect a map of the heavens. Foreign scientists also visit Kitab. In 1958, for example, the Kitab station was visited by Prof. A. Danjon, Director of the Paris Observatory; Prof. M. Minnaert, Dutch astrophysicist, Director of the Utrecht Astronomical Observatory; and the English astrophysicist, Prof. Z. Kopal. The guests became acquainted with the work of the station and the results of our research.

In connection with the current establishment in China of the Tientsin latitude station on this same parallel, $39^{\circ}08'$, a long visit to Kitab has been made by the director of that station, Prof. Tszou I-sin and University Reader Lo Din-tszyan. They studied the methods for making observations in accordance with the international program, and a number of other problems.

("Latitude Service", by A. M. Kalmykov [Director of the Kitab International Latitude Station im. Ulugbek], Nauka i Zhizn', No. 3, 1960, pp. 44-46)

VI. SEISMOLOGY

Appearance of New Island in the Caspian Sea Spurs Petroleum Exploration — News Item

Baku, 17 June (By telegraph from our correspondent). The ship carrying the expedition of the Azerbaydzhan Scientific Research Institute for the Production of Petroleum has returned to Baku. While doing geophysical work in the Caspian the expedition discovered an island approximately 180 km from Baku. The island does not appear on any map.

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This is a new surprise of the Caspian. The island appeared as the result of the recurrent eruption of a mud volcano. The expedition landed on the island, made measurements, took photos and took soil samples. The island is about 300 meters long and rises as much as five meters above the water. It is not impossible that commercial exploration will begin for the "black gold" on or near this island -- provided that it does not disappear.

Azerbaydzhan scientists have determined that the arrangement of mud volcanoes in the central part of the Caspian represents a 200-kilometer underwater petroleum and ~~gas~~ "bridge" between Baku and Western Turkmenia. ("Caspian Surprise", Izvestiya, 18 June 1960, p. 3)

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VII. OCEANOGRAPHY

Soviet Article Contains Notes on Russian Oceanographic Research

The following is the full text of an article from Nauka i Zhizn': Many secrets are still hidden in the depths of the seas and oceans. What, for example, are the causes of the systematic vertical migrations of herring in the North Atlantic to a depth of 100 meters? What is the meaning of the mysterious behavior of sardines on the shores of Africa -- their unexpected diurnal movements for long distances? What does a fish do when it encounters a trawl line or net? How does a fish react to noise and other irritants? Modern science should be able to answer all these and many other questions.

Until recently scientists have conducted complex investigations aboard ships recutfitted from medium trawlers. But it has been impossible to conduct scientific research aboard such vessels on a broad scale. The scientists at Leningrad therefore set out to develop a plan for a special scientific-technical ship (85 meters in length, with a displacement of 3,950 tons, and with a speed of 12 knots). The refrigerator trawler "Mayakovskiy" was built on the basis of this design.

The new vessel is equipped with apparatus which will enable it to stop at fixed points in the ocean and remain at these fixed positions for a long time.

Imagine a transverse tunnel passing right through the prow of a ship! Mounted therein is a propeller operated by a 100-kw electric motor. In conjunction with the screw propeller it makes it possible for the ship to remain in place without dropping anchor. Nothing can move the ship from the point where it is at rest -- neither a wind with an intensity of 6 nor a rapid current.

There will be 10 laboratories on the ship. In the plankton laboratory scientists will be concerned with the investigation of different kinds of plankton (fish food); in the hydrological laboratory -- the collection of samples of sea water from various depths, the measurement of its temperature and salinity, and the study of currents. For this purpose the laboratory is equipped with bathometers for the measurement of water depths, bathythermographs which record the vertical distribution

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of water temperature in a layer as much as 200 meters deep, and other instruments. It is possible to get cores of earth (sea bottom) as long as 35 meters by means of earthen pipes lowered away from the control panel.

Ichthyologists can predict the catch of commercial fish of various species, biologists can study the microflora, and technicians can investigate the technical and chemical properties of articles being subjected to maritime exploitation. It will be possible to conduct experimental research on the thermal processing of fish and fish preservation aboard the vessel.

Finally, there is a special laboratory for techniques to be used in industrial fishing; this is designed for the study of the behavior of fish in zones of fish exploitation and the selection of rational designs for instruments and equipment used in the catching of fish.

Presently the principal means for underwater observations of fish are hydroacoustic instruments which make it possible to determine the location of shoals of fish. But the short lines drawn by the pen of the self-recording instrument do not give a full idea of the actual form of the shoal, its density, or whether the fish are large or small, and cannot tell of what species it consists. It therefore remains necessary for man to make direct observations of the underwater kingdom. Aboard the new ship a hydrostat will be used for this purpose; it was designed by the Giprorybflot (State Institute for the Design and Planning of the Fishing Fleet) and is capable of submerging to a depth of 600 meters, together with a researcher, an underwater television set for "looking" in all directions, and aqualungs.

The new vessel will be equipped with a Soviet-produced electronic instrument for the simultaneous observation of the filling of the trawl net and its depth of submergence. It will increase by many times the effectiveness of the fishing industry. Much excellent deck equipment is also provided. There are various winches on deck for the lowering of plankton and ichthyological nets below the water, for lowering bottom dredges and coring units and a remote-control meteorological station and electromagnetic current meter.

The vessel, in addition to its scientific work, will serve as a large fishing trawler. It will catch fish, process them into fillets, can the fish, make marhades and prepare fish meal and fish oil.

("Institute at Sea", by Eng. N. P. Bolgarov, Nauka i Zhizn', No. 3, 1960, pp. 65-66)

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Quantitative Distribution of Benthos in Part of the Southern Hemisphere

Another article has appeared in a Soviet scientific journal reporting on the scientific results of work aboard the oceanographic research vessel Ob'.

This latest article deals with the findings of the Ob' concerning the quantitative distribution of bottom fauna. Specifically the paper deals with the quantitative distribution of benthos in the Tasman Sea and that part of the world ocean lying between the Indian and Pacific Oceans to the south of New Zealand, including Antarctic waters. Twenty-nine samples were collected at depths as great as 4,800 m. The source material is supplemented by samples collected on the 26th voyage of the research vessel "Vityaz".

The collected material was adequate to serve as a basis for the compilation of a schematic map of the distribution of benthos (Figure 1, not reproduced here). Until now there has been an almost total lack of any information about the quantitative distribution of bottom fauna in this region or in other regions situated within these latitudes of the Southern Hemisphere.

Data for each of the 36 stations is provided in some detail in Table 1.

It is clear that in this area, as in other regions of the world ocean, the quantities of benthos decrease with an increase in depth and distance from the shore. Indeed, the coastal waters of New Zealand are quite similar in their abundance of bottom fauna to coastal regions in analogous latitudes of the Northern Hemisphere in the northwestern part of the Pacific Ocean. As a rule the abundance of benthos is more closely related to nearness to the coast than it is to depth.

("Quantitative Distribution of Benthos in the Tasman Sea and in Antarctic Waters to the South of New Zealand", by G. M. Belyayev [Institute of Oceanography of the Academy of Sciences of the USSR], Doklady Akademii Nauk SSSR, Vol. 130, No. 4, pp. 875-878).

Major Russian Marine Expedition Will Study the Gulf Stream

A major expedition is planned for the conduct of extensive oceanographic research in the vicinity of the Gulf Stream -- the largest and most extensively branched system of warm currents in the northern part of the Atlantic Ocean.

Taking part in the expedition will be seven scientific research vessels. The purpose of the expedition is to collect data in order to determine the extent of the influence of the waters of the Gulf Stream on the thermal balance of the northern seas and atmospheric processes in the North Atlantic.

("In the Region of the Gulf Stream," Izvestiya, 19 June 1960, p. 4)

Report on the Oceanographic Research Vessel "Persey-2"

In the north the scientific research vessel "Persey" is well-remembered. It was aboard this vessel that the work of the Floating Marine Scientific Institute for the Study of Northern Seas began its work in 1922; that institute was created on the initiative of

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V. I. Lenin. That small combined sailing-and-motor ship, with a total displacement of about 550 tons, sailed those icy seas for almost 20 years. A majority of Soviet oceanographers of the older generation travelled aboard her on the expeditionary voyages made by that remarkable school of researchers. This scientific vessel, smashed by bombs, sank in the Kola Gulf in the first year of the Great Patriotic War.

Sailors have an old, old tradition -- that of giving the names of famed ships of the past to newly-launched vessels. Therefore a new "Persey" has again appeared in the northern seas. This ship recently left the port of Murmansk on a long voyage to the Faeroe Islands. A meeting had been arranged there in the port of Westmanhavn with research vessels of a number of other countries.

The editor of this newspaper has made radio contact with the vessel "Persey-2." The chief of the expedition of the Polar Institute of Fishing and Oceanography, M. Adrov, Candidate in Geographical Sciences, reported as follows:

"By decision of the International Council for the Study of the Seas we are now conducting major research in the vicinity of the Faeroe-Iceland threshold. In addition to the "Persey-2" expeditions from Great Britain, Norway, Denmark, Iceland and the Federal Republic of Germany are taking part in this work."

"The principal task of the researchers, headed by the well-known Scotch oceanographer John Tate, is the study of how the cold deep waters of the Sea of Norway penetrate into the northern part of the Atlantic Ocean through the Faeroe-Iceland threshold. These investigations are of immense importance for the development of fishing. The immense expanses of the Sea of Norway between Iceland and the Faeroe Islands will be intersected by a series of parallel traverses. Our 'Persey' has already made one of these runs."

"During the voyage of the 'Persey-2' it will visit Norway, Iceland, the Faeroes, and the Shetlands."

("Naval Tradition," Pravda, 17 June 1960, p. 6)

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VIII. GLACIOLOGY

Glacier Research on Novaya Zemlya -- An Academy of Sciences Report

The glaciological expedition of the Second International Polar Year in 1932-1933, under the direction of M. M. Yermolayev, established that there was no firn or firn ice in the vicinity of the watershed between Russkaya Gavan' and Blagopoluchiye Gulf. There, under a layer of "this year's snow," M. M. Yermolayev (1) discovered blue glacier with the pressure of the gases included therein about 2.23 atm -- normal for depths on an order of 15 m. In the opinion of M. M. Yermolayev, such a high pressure of gases, together with the large-crystal structure of the ice, is evidence of intensive ablation,

during which the pressure of intraglacial gases does not ever balance with atmospheric pressure.

Since then substantial changes have taken place in the glacial cover.

Investigations of the Novaya Zemlya Glaciological Expedition of the International Geophysical Year of the Academy of Sciences of the USSR at Russkaya Gavan' in 1957-1958 have established the following:

1. The period with positive air temperatures in the region of the ice divide is a total of 5 to 5½ weeks; the balance of matter at a height of 776 m is positive and equal to 20 cm of firn (with a water supply of 20.3 mm).

2. In the fall of 1957 the snow line was situated at a height of 570 m -- on the brow of the "Yablonskiy Barrier," a feature caused by a subglacial terrace.

3. The thickness of the firn increases very rapidly from the Yablonskiy Barrier to the ice divide, where it attains a thickness of 16 m. White firn ice with a mass of air bubbles underlies it.

4. The alternation of layers of firn and ice somewhat above the snow line is evidence of an annual increase of 10 to 20 cm of snow. In a six-meter trench, 115 cm deep, six such layers were discovered, separated by continuous ice lenses at depths of 12-14; 27.6-29; 39-41; 65-67 and 89-92 cm. Judging by the thickness of the snow bridge over the trench, the thickness of the firn in this region is no greater than 2 m. Consequently, it was formed in approximately 10 to 12 years.

5. In the region of the ice divide the layers of annual snow increment amount to 32; 14.5; 15; 39 and 23 cm respectively.

6. Below the brow of the Yablonskiy Barrier a whitish ice with small bubbles was exposed on the surface of the glacier; it was free of solid (mineral) impurities. This zone of ice occupies no more than 2 km. Then, deeper, it is replaced by banded ice, made up of long parallel bands of bluish and whitish-blue ice of approximately equal width (10 to 20 cm), oriented in the direction of the movement of the glacier. In 3 to 3½ km this ice is replaced by blue deep glacial ice, streaked with chaotic veins of congealed ice.

According to measurements made by the expeditions in 1932-1933 and 1957-1959, the speed of movement of the ice in the outlet tongue of this sector of the glacial cover (in the Shokal'skiy glacier) is equal to approximately 150 m per year. Assuming that the speed of movement of the ice only decreases insignificantly from the fact of the Shokal'skiy Glacier to the Sommeniye Barrier, as can be seen from a comparison of the velocities of movement of ice at the face and at 11 km from it, it is necessary to relate the beginning of the appearance of the whitish ice in the region of ablation to the end of the 1930's.

From an analysis of the variations of the ice characteristics of the White, Barents and Kara Seas, made by V. S. Nazarov (2), we can see a progressive decrease in the ice content of these seas since the beginning of the 1930's; this is still continuing. The decrease in the

ice content of these seas is due to the intensification of cyclonic activity in the atmosphere, accompanied by an increase in the receipts of moisture; this explains the renewal of the firn deposits feeding the Novaya Zemlya glacial cover. With the maintenance of the now-existing regime of atmospheric "feeding" of the cover to the end of the present century -- and V. S. Nazarov has made such a prediction in respect to the ice content of the seas mentioned -- at the end of the century we should expect if not a cessation of the retreat of the face of the outlet tongue of the investigated part of the Novaya Zemlya ice cover, then, at least, a lag in the rate of retreat.

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IX. ARCTIC AND ANTARCTIC

Latest Report on the Drift Station "SP-8"

The following is a summarized version of a Sovetskaya Aviatsiya article of 17 June.

The author took off from Tiksi in a heavily-laden "IL-14" and headed northwest. The pilot was F. Shatrov, Hero of the Soviet Union; the other crew members were named. The flight continued several hours before the huts and tents of the "SP-8" were sighted. The "IL" touched down on the ice and travelled several hundred meters before coming to a stop. This was not the first plane to arrive that day because the transporting of freight to the "SP-8" is now in full swing and aircraft are shuttling back and forth. Temporarily based on the station is an "AN-2" and four ski-mounted "Li-2" aircraft. The station was recently visited seven times by an "AN-10" piloted by the airmen V. Vasil'yev and G. Bardyshev. It delivered 65 tons of fuel and other freight. It was the first time in the history of aviation that a heavy turbojet plane had landed on the drift ice on a limited landing area.

The author was met by the chief of the new staff of the "SP-8", hydrologist Nikolay Ivanovich Blinov. The latter is quoted as indicating that the new staff was made up of members of the Komsomol organization; a number of participants are named, together with their assignments.

The author mentions that the ice floe has been repeatedly subjected to compressive forces. The landing strip has suffered cracks on 19 occasions, but these have been repaired. During the year the floe has travelled a sinuous course over 2,000 km long.

The huts on the "SP-8" are clean, snug, and warm. There is electricity, telephones and radios. In their free time the polar specialists gather in the dayroom, look at movies, read newspapers, and play chess. ("Flight to the Pole", by M. Filipenin, Sovetskaya Aviatsiya, 17 June 1960, p. 6)

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